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DEPARTMENT OF EDUCATION

SYLLABUS

for

General Mathematics

1, 2 *and* 3

of the Programme of Studies

for the High School

Authorized by the

DEPARTMENT OF EDUCATION

EDMONTON:
A. SHNITKA, KING'S PRINTER
1939

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GENERAL MATHEMATICS

The courses in General Mathematics are offered to meet the needs of students whose special aptitudes or interests do not lie in the field of Mathematics, but for whom, nevertheless, some knowledge of fundamental mathematical concepts and the application of these to practical situations of life will be of value. It is also a necessary course for students entering the senior high school with "C" standing from Grade IX, who desire ultimately to proceed with academic rather than with general subjects, and who can therefore profit from remedial work in Mathematics before undertaking the courses in Algebra 1 and Geometry 1.

To meet the needs of such a divergent group of students, the courses in General Mathematics must contain a wide variety of topics from which the teacher may select those most appropriate to the needs of his class. He may give the course a commercial, technical or academic "bias". As suggested by the Regulations of the Department of Education for the year ending June, 1939, he may "dilute" the course if he finds it too difficult for his particular class. It is fundamental that the teacher decide early in the school year the particular bias the class will follow and to treat the course accordingly.

The "integration" that distinguishes a course in General Mathematics from the older courses in specialized subject-matter is to be sought not so much in the content as in the classroom procedure for applying this content in a practical way to the solution of problems on which the student is working. **It cannot be stated too emphatically that the teacher is not required to "cover" any prescribed minimum or core of work. The really important thing is that students be kept working at optimum efficiency throughout the year on meaningful problems which have some practical interest for them. The aim is not to enforce a standard but to increase the students' understanding and practical efficiency.**

THE TEACHER IS ASKED TO NOTE THAT IN GENERAL MATHEMATICS STUDENTS SHOULD BE ENCOURAGED TO USE IN EACH PROBLEM, WHETHER ALGEBRAIC, GEOMETRIC OR TRIGONOMETRIC, THE MOST USEFUL METHOD OF SOLUTION AVAILABLE.

Vocabulary

Teachers are reminded that some time should be devoted to helping students master the spelling and meaning of all new words belonging to the technical vocabulary of Mathematics. For example, such words as adjacent, alternate, altitude, complementary, diagonal, hypotenuse, intersect, inscribe, directed number, equation, factor, formula, index and indices, Pythagoras, symbol and linear, should be mastered by the student. Teachers are expected to prepare their own vocabulary check-list and to make use of such a list during the work of the term.

Oral and Written Expression

The attention of teachers is also directed to the fact that oral and written expression in English are to be considered as an important

part of every course, and especially of Social Studies, Mathematics and Science. In no subject is correct and accurate expression of more importance than in Mathematics.

List of Reference Books

No single textbook can be prescribed that will be adequate for the needs of all types of student in this subject. It will therefore be necessary that every classroom for General Mathematics be equipped with a classroom library of reference books in which suitable material can be found for class work.

Such a library should include all books which the teacher has found to be useful and, in addition to these, half a dozen at least chosen from the following list. This list of reference books is numbered, and in the outline which follows it, reference is usually made to the number as it appears on this list, but not to the title of the book. Following the numbered list is a further list of reference books which teachers may find useful for special purposes.

1. BUSINESS ARITHMETIC: Thompson—Prentice-Hall.
2. ESSENTIALS OF BUSINESS ARITHMETIC: Kanzer & Schaaf —D. C. Heath.
3. MATHEMATICS FOR TECHNICAL SCHOOLS: Warren & Rutherford (1935 Edition)—Copp Clark.
4. PRACTICAL MATHEMATICS: Palmer—McGraw-Hill Book Co. Part IV: Trigonometry and Logarithms.
5. PRACTICAL GEOMETRY: Siddons & Hughes—Cambridge University Press (Macmillan Co.).
6. A COMMERCIAL ARITHMETIC FOR SECONDARY SCHOOLS: Batstone—Ryerson Press.
7. MATHEMATICS FOR TODAY: LaZerte and Betz—Ginn & Co.
8. ALGEBRA FOR TODAY: Betz, Robinson and Shortliffe—Ginn & Co.
9. FUSION MATHEMATICS: Freilich, Shanholt and McCormack—Silver-Burdett.
10. ARITHMETIC FOR ENGINEERS: Clapham—Chapman-Hall.
11. FIRST YEAR ALGEBRA: Hawkes, Luby and Touton—Ginn & Co.
12. MATHEMATICS FOR MODERN LIFE: Joseph P. McCormack—Appleton-Century Co. (Ryerson Press).
13. ARITHMETIC OF BUSINESS: McMakin, Marsh & Baton—D. C. Heath.
14. FIELD WORK IN MATHEMATICS: Shuster-Bedford—American Book Co.
15. APPLIED MATHEMATICS FOR GIRLS: Bruce Publishing Co., Milwaukee.
16. PLANE TRIGONOMETRY: Conant—American Book Co.
17. FUNDAMENTALS OF STATISTICS: Thurstone—Macmillan Co.
18. PRACTICAL MATHEMATICS: Horace Wilmer Marsh—John Wiley & Sons. Vol. IV: Technical Trigonometry.

19. PLANE TRIGONOMETRY AND APPLICATIONS: Wilczynski & Slaught—Allyn & Bacon.

20. PLANE TRIGONOMETRY: Reed—G. Bell & Sons.

21. EXCURSION IN MATHEMATICS: E. R. Breslich—Orthovis Company, Chicago.

22. MATHEMATICS IN DAILY LIFE: Barker and Morgan—Houghton Mifflin Co.

23. ALGEBRA FOR USE: Mathematics for Junior High Schools, Book Three—John C. Winston Co.

24. THE CONSUMER INVESTIGATES: ZuTavern & Bullock—Commercial Textbook Company, South Pasadena, California.

MATHEMATICAL AND PHYSICAL TABLES by John B. Clark (Oliver and Boyd) may be obtained from the School-Book Branch, Department of Education. Price 25c.

Additional Reference Books

PRACTICAL MATHEMATICS: Palmer—McGraw-Hill Book Co.

Part I: Arithmetic with Applications.

Part II: Algebra with Applications.

Part III: Geometry with Applications.

PRACTICAL MATHEMATICS: Horace Wilmer Marsh—John Wiley & Sons, N. Y.

Vol. I: Industrial Mathematics.

Vol. II: Technical Algebra.

Vol. III: Technical Geometry.

Vol. I has some good material on practical applications. Vol. II gives a good treatment of variation, logarithms and the slide rule.

NEW PLANE GEOMETRY: Stone-Mallory—Benj. H. Sanborn & Co.

NEW SOLID GEOMETRY: Stone-Mallory—Benj. H. Sanborn & Co.

PLANE GEOMETRY (Life Interest Series): Sykes, Comstock and Austin—Rand-McNally Co.

SOLID GEOMETRY (Life Interest Series): Sykes, Comstock and Austin—Rand-McNally Co.

PLANE GEOMETRY: Strader & Rhoades—John C. Winston Co. (The five books on Geometry just mentioned give some excellent suggestions for creating interest in Geometry by showing its practical applications to activities of everyday life.)

THE TECHNIQUE OF TEACHING SECONDARY SCHOOL MATHEMATICS: Breslich—University of Chicago Press.

THE TEACHING OF ELEMENTARY ALGEBRA: C. V. Durrell —G. Bell & Sons.

FUNDAMENTAL SKILLS OF ALGEBRA: J. P. Everett—Teachers College, Columbia University.

THE TEACHING OF ELEMENTARY MATHEMATICS: Godfrey and Siddons—Macmillan Co.

THE TEACHING OF SECONDARY MATHEMATICS: Hassler and Smith—Macmillan Co.

ENRICHED TEACHING OF MATHEMATICS IN HIGH SCHOOLS: Woodring and Sandford—Teachers College, Columbia University.

SIXTH, SEVENTH, EIGHTH, TENTH and ELEVENTH YEARBOOKS OF THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS: Bureau of Publications, Teachers College, Columbia University, New York. (The Sixth Yearbook deals with Mathematics in Modern Life.)

THE TEACHING OF GEOMETRY IN SCHOOLS: A Report prepared by the Mathematical Association—G. Bell & Sons.

A Second Report on the Teaching of Geometry in Schools prepared by the Mathematical Association—G. Bell & Sons.

MEMORANDA ON TEACHING AND ORGANIZATION IN SECONDARY SCHOOLS—Geometry, Circular 851—Board of Education (His Majesty's Stationery Office, London).

THE REORGANIZATION OF MATHEMATICS IN SECONDARY EDUCATION, Part I: Riverside Mathematical Monograph Series—Houghton Mifflin.

THE TEACHING OF ALGEBRA (INCLUDING TRIGONOMETRY): Sir T. Percy Nunn—Longmans' Modern Mathematical Series.

EXERCISES IN ALGEBRA (INCLUDING TRIGONOMETRY) Parts I and II: Sir T. Percy Nunn—Longmans' Modern Mathematical Series.

EXERCISES IN ARITHMETIC AND MENSURATION (WITH DIAGRAMS): T. P. Abbott—Longmans' Modern Mathematical Series.

THE TEACHING OF ARITHMETIC: T. P. Abbott—Longmans' Modern Mathematical Series.

A SCHOOL COURSE IN GEOMETRY: W. J. Dodds—Longmans' Modern Mathematical Series.

General Mathematics 1

Each course consists of two Sections, A and B. Section A includes studies and practice suggested as a core for all students. Section B is divided into three parts, the one to be selected depending upon the type of school or of class.

IT IS IMPORTANT THAT THE TEACHER CONSIDER HIMSELF FREE TO TREAT THIS ORGANIZATION OF THE COURSE AS SUGGESTIVE, SUITING HIS PLAN OF WORK TO THE SITUATION WHICH CONFRONTS HIM. Some students may require much remedial work in Section A, others may require little, and there are many optional topics which teachers may well include for the latter group.

No one textbook can be prescribed. It is expected that a considerable number of the books listed for reference will be made available for use in every classroom library. Several of the books listed are used as textbooks in other courses of the high school programme.

For the work in logarithms and Trigonometry the students should be required to obtain a suitable set of tables. "Mathematical and Physical Tables" by J. B. Clark (Oliver and Boyd, London) will be found very satisfactory and may be obtained locally for 25c. Teachers wishing to use the bar system of logarithms will find no difficulty in the use of these tables, which use the "10" system; e. g. log. tan 5° is given as 8.9420, but this can be converted to 8.9420—10=$\bar{2}$.9420.

Informational and "Socialized" Arithmetic

It is not intended that the work in any class should be wholly computational. Much informational and practical work should be introduced. For example, when teaching the topic "Fire Insurance" in Commercial Arithmetic, the instructor should, after showing how to compute the premium at any given rate, say 95 cents, discuss the different factors affecting the rate—basic rate for any community based on the efficiency of the fire-fighting forces and equipment and the frequency of fires, type of building construction, distance from adjacent buildings, distance from fire hydrants and the purpose for which the building is used. An attempt should be made to have the students answer such questions as the following: "Why is the rate of interest charged to Western farmers higher than that charged to Eastern farmers? Why are Dominion of Canada 4½'s due in 1959 quoted at 112 while Alberta 4½'s due in 1956 are quoted at 57? Why does the rate of interest fluctuate?"

Teachers will find valuable directions on this type of approach to General Mathematics in Chapter IV of "Relation of Social Arithmetic to Computational Arithmetic," by Busell in the Tenth Year Book of the National Council of Teachers of Mathematics (Teachers College, Columbia University, New York), and in "The Technique of Teaching Secondary School Mathematics," by Breslich (University of Chicago Press). Further remarks on this aspect of Arithmetic will be found in Section B, Division II—ARITHMETIC OF BUSINESS AND OF THE HOME.

Just as in the lower grades the use of "enterprises," projects and activity units has been found necessary for the purpose of motivating the learner, so in intermediate and high school grades **units of work grouped around "centres of life interest" will be much more effective for the purpose of teaching Arithmetic to students of average ability than the traditional categories of the orthodox textbook in Arithmetic.** This point should not be overlooked by teachers who attempt to offer "remedial" instruction in Arithmetic.

SCHEME OF WORK—GENERAL MATHEMATICS 1

Section A:

Division I—Arithmetic (mainly remedial).
Division II—Logarithms.
Division III—Mensuration.

Section B:

Division I—Remedial and Practical Algebra and Geometry.
Division II—Commercial Arithmetic (for Commercial students.)
Division III—Algebra and Technical Arithmetic (for Technical students.)

Division I

Remedial Instruction In Arithmetic

Remedial instruction, to be of educative value, must have two important characteristics:

1. Exploration by the teacher of the student's individual patterns and habits of thought and practice for the purpose of straightening out "kinks" that hold up the student's further progress.

2. Avoidance of dreary repetition of "type problems" and meaningless routine.

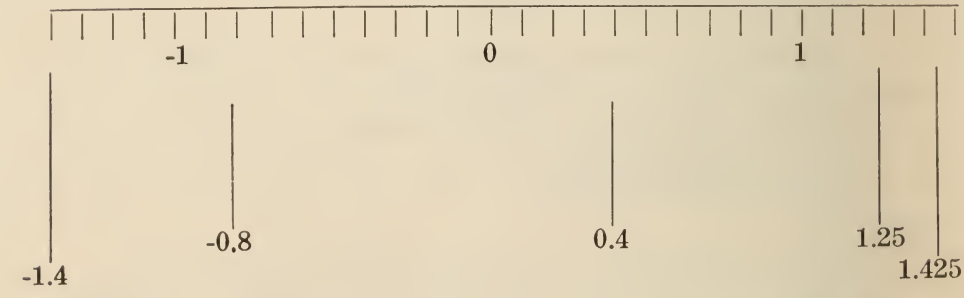
Unless the instruction actually touches the student's difficulty, it will not succeed, no matter how often the exercises are repeated or how many hours are devoted to them. Moreover, a student who is not to be inspired by an array of problems on "percentage" or "bank discount," or the length of time taken by A, B and C working together to do a piece of work, may, after all, find something comprehensible in problems that spring from an attempt to balance the family budget or other problems in the field of his own immediate experience. Many students who require remedial instruction in Arithmetic have had the full benefit of traditional procedures. With such students, it is obviously necessary to try some of the newer procedures.

N. B.—For the following units of Division I, the use of any good textbook in Arithmetic will be satisfactory. The HIGH SCHOOL ARITHMETIC, by Stanley and Smith, formerly used as the textbook for Arithmetic 1 of the unrevised Grade XI programme is now out of print and will not, therefore, be available.

1. Vulgar Fractions. **References.**—No. 3, Chapter I, page 4.
   No. 6, Chapter II.

2. Decimal Fractions, including simple examples of circulating decimals. **References.**—No. 3, Chapter III, page 23.
   No. 6, Chapter II.

3. The meaning of decimal fractions as applied to scales. Practice may be secured in reading radio scales, watt-meter, micrometer scales, verniers, slide-rules. Some stores of the "five and ten cent" type offer vernier-calipers, micrometers, and slide-rules at prices of a few cents. Instruments from the laboratory of the school also offer opportunities for practice in scale-reading, and in making decimal approximations. Curved and non-uniform scales should be included. The teacher and students may construct problems such as the one below:



It should be emphasized that all measurements are approximations.

4. Changing vulgar fractions to decimal fractions and vice versa.
   References.—As above.

5. The Metric System.
   References.—No. 3, Chapter IV, page 45.
   No. 6, Chapter VI.

6. Elementary work on powers and roots including formal method of extracting the square root of numbers, and practice in the use of tables of square roots. Some elementary work on surds such as removing the square factor, addition, subtraction, multiplication and division of simple quadratic surds.
   References.—Clark's Tables, page 21.
   No. 7, table on page 351.
   No. 8, pages 170-185.
   No. 6, Chapter VII, and tables, page 332.

7. Ratio.—Elementary ideas involved in sharing problems and problems arising from model-building and from enlarging and reducing plans, maps and photographs; trigonometric ratios.
   References.—No. 23, Chapters X and XI.
   No. 7, Chapter XV.
   No. 8, pages 144-150.
   No. 3, Chapter VIII, page 108.
   No. 6, page 56.
   (Stanley and Smith's *High School Arithmetic*, Chapter V.)

8. Percentage.—Review of elementary work. Relation between percentages, decimals and fractions; and a table to show this relation for commonly used percentages. Aliquot parts.
   Percentage as a ratio.
   Simple problems illustrating common use of percentages.
   References.—No. 2, page 20.
   No. 6, page 53.

Division II. Logarithms.

The work on logarithms should not be treated as a formal discussion of the theory of logarithms but rather as a useful tool to eliminate, or at least to minimize, the drudgery of long mechanical arithmetic operations. This work should be taken before mensuration and used freely in the solution of mensuration problems. Practice in the use of logarithms must precede their use in mensuration, but their use must not stop there. In many of the Arithmetic texts formerly used, such numbers as would "cancel" out nicely in the solution were included in the given data. This seldom occurs in practice and should be discontinued in the classroom. Problems should be of a practical nature, and for such problems logarithmic computation is a useful tool.

Logarithms to the base 10 only should be used. A procedure similar to the following has been found suitable for Grade X students:

$10{,}000=10^4$	$1/10=10^{-1}$
$1{,}000=10^3$	$1/100=10^{-2}$
$100=10^2$	$1/1{,}000=10^{-3}$
$10=10^1$	$1/10{,}000=10^{-4}$
$1=10^0$	

The logarithm is merely the power of 10 (the base) which produces the number; hence log. 100=2, log. 1,000=3, log. 1=0, etc. Since

50 lies between 10 (10^1) and 100 (10^2), log. 50 lies between 1 and 2; that is, it would be 1 plus a fraction; this fraction as a decimal fraction can be found in the table of mantissas, etc.

Finding the antilog can be developed as a reverse of the above scheme.

References.—No. 4.
No. 23, Chapter XV.
No. 3, Chapter XI, page 192.
No. 8, Chapter VIII.
No. 9, Chapter XIII.

Division III. Mensuration.

(a) **Lines.** (1) Perimeters of common geometric figures—rectangle, triangle, circle, etc.
(2) Right-angle-triangle.
(3) Arcs of circles.

(b) **Areas.**
(1) Rectangle.
(2) Parellelogram.
(3) Triangle — use of both formulas: $\frac{1}{2}$ bh and $\sqrt{s(s-a)\ (s-b)\ (s-c)}$
(4) Trapezium.
(5) Circle.
(6) Prism, including cylinder.
(7) Irregular surfaces—counting squares, weighing.

(c) **Volumes.** Wherever possible, models should be used for experiment. Solid models may be constructed from potato, clay or wood. These may be immersed in an overflow can, and volume of water displaced may be measured by a graduated tube.
(1) Rectangular solid.
(2) Prisms, including cylinder.

References.—No. 3, pages 82-107; 205-235.
No. 6, Chapters VIII and IX.
No. 23, Chapters IV and VII.

Section B

Division I. Remedial and Practical Algebra and Geometry.

Classes that are not definitely specializing in commercial or technical electives may find the material in this section of value, much of which can be done in connection with mensuration. Students should be encouraged to use the geometric and algebraic ideas obtained from the General Mathematics of Grade IX, and to develop the practical applications of these ideas. Much of the work can be treated as remedial and will therefore be of value to students who desire to proceed in their second year with Algebra 1 or Geometry 1.

1. Positive and negative numbers:
(a) Their operational (direction-distance) meaning.
(b) Their positional meaning.

Note: Few texts treat these topics adequately. Some good material may be found in Reference No. 11.

(c) Development of simple operations with numbers in the extended (positive-negative) range.

(i) By inferences from illustrations. See Reference No. 7, Chapter V; and No. 23, Chapter V.

(ii) By arbitrary extensions of operations from the positive to the negative scale.

Note: This, by all means the easier procedure, is overlooked by nearly all authors. An attempt is made, however, in Reference No. 11.

2. Simple equations and formulas involving one variable.

References.—No. 8, Chapter I; and No. 23, Chapters I and IX.

3. Problems of a practical nature involving one variable.

Reference.—No. 12, Chapter 8.

4. Linear equations in two variables with their use in solving simple problems. Solutions of a linear equation in two variables and points on its graph. The two-solution method of drawing the graph. Common point and common solution. Show that the "add and subtract" treatment of two such equations is valid at the common point only. Suitable applications in Reference No. 8, Chapter II.

5. Special products and their factors:

(a) Common factor.

(b) Square trinomials.

(c) Trinomials such as, $x^2 - 5x + b$. (By analogy called rectangular trinomials.)

(d) Difference of squares.

Reference.—No. 8, Chapter III.

6. (a) Positive integral exponents—their meaning and simple operations with them.

(b) Roots as inverse of powers. Fractional exponents—to be treated theoretically or as arbitrarily assigned notation in varying degrees in accordance with classroom conditions. Roots to be restricted to rational and a few very simple irrational roots. Reading squares and square roots from the graph of the function x^2. All complicated operations with surds to be omitted. See Reference No. 23, Chapter XII.

(c) The zero exponent.

(d) Negative integral exponents—to be treated as an arbitrary notation with such theory as conditions justify. Scientific use of positive integral and negative integral exponents with the base 10, as shown in Reference No. 8, Chapter VI, pages 167, 168.

The work of Grade IX Geometry should be strengthened and extended, with additional practical emphasis. Reference No. 5 contains ample material for this purpose. The first chapters cover the Grade IX material.

These chapters set forth an abundance of problems, including three-dimensional problems.

The following principles are needed in mensuration:

(a) Locating the centre of an arc of a circle.

(b) The angle in a semi-circle.

(c) Tangents.
(d) The inscribing of a circle in the triangle and square and *vice versa.*
(e) The rudiments of ratio and similarity.

All these matters are amply treated in the later chapters of No. 5. There are chapters devoted to the prism, cylinder, cone, sphere, etc.

Division II. Arithmetic of Business and of the Home.

The traditional course in Commercial Arithmetic consists mainly of the applications of percentage to business transactions. The course is usually set forth as a series of topics, and the usual procedure has been to illustrate each of these topics by means of a more or less extensive set of graded problems specially selected to illustrate the particular topic under consideration. In some of the older textbooks each set of problems included a number of converse problems which were supposed to provide excellent mathematical discipline for the student.

This older procedure, however, is no longer effective for the majority of high school students who study Arithmetic; and for the reason that such students do not experience life situations in which the arithmetical problems encountered are classified in textbook categories with data neatly arranged in the best logical form. The trend today, therefore, in the teaching of Arithmetic lies in the direction of what is called "socialized" Arithmetic; that is to say, the Arithmetic exemplified in the day-by-day activities of social life and relationships. These situations are much more meaningful to the student of average ability than the abstractions from the older textbooks.

The Topical Procedure.

To students of more than average ability who are specializing in commercial subjects and have a vocational outlook in their study of Arithmetic, a treatment of the following topics may be offered:

(1) Trade Discount.
(2) Profit and Loss.
(3) Commission.
(4) Insurance — fire, auto, hail, plate glass, theft, weather, etc.
(5) Taxes—land, income, sales.
(6) Duties—excise and customs.
(7) Simple Interest.
(8) Bank Discount — Direct problems, and finding the interest rate equivalent to the discount rate.
(9) Instalment buying.
(10) Partial Payments.

References.—Nos. 1, 2, 6 and 13; Nos. 22 and 24.

It cannot be too strongly urged that teachers spend a considerable share of the class time in presenting the informational side of Commercial Arithmetic. If the course is purely one of computation, a great deal of its value and interest to the student is lost. The informational content will repeat in a more extended form a considerable amount of material that will already have been taken by many of the students in their Grade IX course in Junior Business and Elementary Bookkeeping, and some of it in their Grade IX course in Social Studies. Obviously, any course in business Arithmetic has many points of contact with Social Studies which the alert teacher will not overlook.

Life-Interest Units.

It is here suggested that for students who are not specially interested in a vocational outcome for their study of commercial Arithmetic, the teacher group problem data and materials in units of work similar to the following which may be taken as examples:

1. The Family Budget for Food, Clothing, Shelter and Recreation: cost of a well-balanced diet; the "stretching" of purchasing power by planning; waste in the home expenditures; the cost of clothing—ready-made vs. homemade, bargain sales; the cost of education, of recreational and cultural activities.
2. Buying: cash vs. credit—the reason for the vast extension of credit buying during the last ten years; "charge accounts," instalment buying and computation of rate of interest; quantity buying.
3. Owning a home: cost of up-keep—taxes, insurance, allowance for depreciation; owning vs. renting.
4. Owning an automobile: original cost; depreciation; cost of operation and up-keep. How much does it cost the average person to own and operate a car for a year?
5. Investment of savings: interest—simple and compound; securities; bonds; debentures; stocks; mortgages; annuities; savings certificates; insurance as an investment.
6. Life Insurance: life expectancy and mortality tables; different plans of insurance; the cost of insurance; the cash surrender value of insurance policies; loans on insurance policies.
7. Taxation in Alberta:
   (a) Indirect taxes paid to the Dominion Treasury through duties, customs and excise, Dominion sales tax.
   (b) The Dominion income tax.
   (c) Provincial taxes in Alberta—the income tax, the amusement tax, the gasoline tax; Alberta's problem of finding through direct taxation adequate support for necessary social services, including education, public health, etc. (In connection with these topics teachers will find some excellent material in "The Case for Alberta.")
8. The Dominion and Provincial Budgets—analysis, showing percentage distribution, with circle graphs to illustrate. (See Reference No. 7, page 99.) Similar studies of the "tax dollar" in cities, municipalities, and school divisions or districts.
9. The production of wealth in Alberta and in the Dominion of Canada: the monetary value of this wealth; capital investment and the distribution in different types of productive industry; the national income of Canada and the income of Alberta—the distribution of these incomes and the amount available to consumers as purchasing power.
10. Problems of the wheat grower, the dairy farmer, the coal producer, etc., in Alberta: the cost of production; co-operative marketing; the problem of farm debt in Alberta.

References.—No. 22 and No. 24.

Data for a great variety of problems in connection with these last four units may be found in the "Canada Year Book," and in "The Case for Alberta."

Division III. Algebra and Technical Arithmetic.

1. With General Shop and Shop Subjects.

Here the ideal set-up would be that the shop instructor should also be the instructor in Mathematics. Since this is rarely possible, the instructor in Mathematics should keep in mind that shop-work should be the background for the work in Mathematics, and he should keep constantly in touch with the shop instructor and to a large extent draw his examples from the work being done in the shop.

The work in Divisions I and II of Section A should be emphasized and elaborated. Pupils should be trained to estimate their answers as a check on their actual solution. All answers should be examined from the point of view of reasonableness.

It is suggested that a selection be made from the following topics:

(1) Use of formulas for areas of surfaces other than those given in Section A (3); i. e. ellipse, regular polygons, segments of circles, etc. (In reference to the circle use π D and $\frac{\pi D^2}{4}$ rather than $2\pi R$ and πR^2.)

(2) Simple uses of specific gravity.

(3) Board Measure.

(4) Use of Algebra in formula work, changing subject of formula, simple equations, equations in two variables.
See Reference No. 3, pages 280-296.

(5) Use of Geometry in drawing plans, perpendiculars, parallels, etc.

(6) Use of tables of weights of materials, specific gravity, conversion tables, equivalents, etc.
References.—No. 3 and No. 10.

2. With Home Economics.

Some of the units of work suggested for Division II of this section may be found suitable. These may be supplemented with some or all of the following units:

(1) Simple Accounting.

(2) Instalment Buying.

(3) Power and fuel problems.

(4) Problems in cooking.

(5) Dressmaking problems.
Reference.—No. 15.

General Mathematics 2

In the second unit in General Mathematics, the same arrangement is kept as in the first unit; viz., the work is divided into two Sections of three Divisions each, as shown in the scheme below. The teacher, having decided at the beginning of the school year on the particular bias his class is to follow, will stress certain of the Divisions of Section A and supplement them with topics chosen from the supplementary outline of Section B for his particular type of class.

Scheme of Work

Section A:

Division I—Mensuration and Geometry.
Division II—Trigonometry.
Division III—Graphs.
Division IV—Statistics.

Section B:

Division I—Algebra, Geometry and Trigonometry.
Division II—Commercial Mathematics.
Division III—Technical Mathematics.

The intention is not that the work in Section A be completed before the class proceeds to supplementary topics, but rather that the teacher, having decided on the work his class will take, shall arrange the order and amount of work in the best manner possible.

For example, a teacher having decided that his class must have a "commercial" bias would not stress Division I of Section A as heavily as he would if his class were "technical." He might select work from some or even all of the Divisions of Section A, but he should relate this work closely to Division 2 of Section B.

Division I. Mensuration and Geometry.

1. Review of first-year formulas.
2. Areas of the surfaces of pyramid, cone, frustra of both, sphere, annular ring.
3. Volumes of pyramid, cone, frustra of both, sphere.
   Note: Formulas involving the radius should also be given in terms of the diameter; e. g., $4/3\ \pi\ r^3 = 4/3\ \pi\ (d/2)^3$ and $= \frac{\pi\ d^3}{6}$.
4. Volumes of compound solids.
   Note: (1) Make the work as objective as possible by reference to numerous simple practical problems.
   (2) Continue the use of logarithms as a useful tool in minimizing mechanical work.
   References.—No. 3, pages 205-235.
   No. 1, pages 104-130.
   No. 5, Chapters 20-22, 24 and 25.
5. Ratio and proportion; similar figures—both plane and solid. Stress on length, area and volume.
   Reference.—No. 5, Chapters 16-18.
6. Ratio and proportion (and variation)—other applications.
   Reference.—No. 8, Chapter V.

Division II. Trigonometry.

1. Angles, positive and negative; systems of measurement.
   References.—No. 4, Chapter 2.
   No. 16, Chapter I.

2. Trigonometric Functions: sine, cosine, tangent, cotangent, secant, co-secant, in terms of ordinate, abscissa and distance for any angle between 0° and 360°.

   References.—No. 4, Chapter 3.
   No. 16, Chapters II and V.
   No. 9, Chapter VII.

3. Trigonometric functions of common angles 0°, 30°, 45°, 60°, and 90°. These are to be read from figures, not memorized. Use of these values to find the value of functions of 120°, 135°, 150°, 180°, 210°, 225°, 240°, 270°, 300°, 315°, 330°, 360°.

4. Use of tables to find trigonometric functions of any angle between 0° and 360°.

   References.—No. 4, Chapter 4.
   No. 9, Chapter VII.

   Mathematical and Physical Tables: John B. Clark—Oliver and Boyd, Edinburgh and London.

5. Solution of right triangle by use of natural functions and logarithms.

   References.—No. 4, Chapter 5.
   No. 16, Chapter IV.

   Note: Teachers wishing to use the "bar" system of logarithms will find no difficulty with Clark's tables; e. g., log. tan 5° $=8.9420$ or $8.9420-10=\bar{2}.9420$.

6. Problems dealing with heights and distances, and angles of elevation and depression, and involving the solution of the right triangle.

   References.—No. 4, Chapter 5.
   No. 16, Chapter IV, Chapter XIII, pages 158-161.

Division III. Graphs.

Much of this work may be done in connection with the work of Division IV. The pupils have had some experience with statistical graphs in Grade IX. See Reference No. 7.

(a) Bar Graphs.
(b) Line Graphs.
(c) Distribution Graphs.
(d) Graphs of first degree functions—slope.
(e) Graphs of second and higher degree functions, particularly as relating to formulas; e. g. $A = \pi r^2$; $s = \frac{1}{2}at^2$.
Particular cases of Amount: $P(1-a)^n$; e.g. $150(1.05)^n$.

References.—No. 3, Chapter IX, page 114.
No. 10, Chapter IX.
No. 9, Chapter VIII.
No. 23, Chapter VIII.

Division IV. Statistics.

1. In addition to the work on graphs mentioned above, the meaning and use of the following terms:
   (1) mean (2) median (3) mode
2. Graphs of frequency distribution.
3. The standard deviation.

References.—No. 17; No. 9, Chapter XVII.

Section B

Division I. Algebra, Geometry and Trigonometry.

(For classes not definitely Commercial or Technical.)

1. Review and extension of work on type products and factoring.
2. Algebraic fractions and problems involving same—not too complex.
3. (a) Special products and their factors.
   (i) Common factor obtained by grouping terms.
   (ii) Sum of Cubes.
   (iii) Difference of Cubes.
   (iv) Factor theorem and its bearing on solving simple equations.

   Reference.—No. 8, Chapter III.

   (b) Operations with simple algebraic fractions.
   Reference.—No. 9, Chapter IV.

   (c) Simple operations with quadratic surds, rationalizing denominators.
   Reference.—No. 8, pages 173-185.
4. (a) Plotting graphs of quadratic functions; reading roots of quadratic equations from graphs of quadratic functions.

   (b) Solving quadratic equations by factoring the function and by formula.

   Reference.—No. 8, Chapter VII.
5. Additional geometry: the circle, loci, lines and planes.
   Reference—No. 5, Chapters 10-15; Chapters 18, 19, 23.
6. Laws of Sines and Cosines.
7. Using the Laws of Sines and Cosines in solution of oblique triangle.

   References.—No. 4, Chapters 4 and 9.
   No. 16, Chapters XII and XIII.

Division II. Commercial Mathematics.

In addition to work in Section A, the following topics:

1. Exchange—direct.
2. Partnership.
3. Stocks and Bonds—note treatment of "brokerage" in Reference No. 2.
4. Compound Interest—with tables.
5. Present Worth—with tables.
6. Comparison of Simple Interest, Compound Interest and Present Worth by graph.
7. Simple Annuities. (Formal theory of the Geometric Progression not required.)
   (a) Explain the series.
   (b) Show how to locate any term.
   (c) Give formula for the sum of any number of terms, and for sum to infinity.

   Involved problems are to be avoided.
8. Mortgages, Bonds, Debentures.

A very good treatment of the mathematics of investment and financing may be found in Chapter 5 of Reference No. 6—**A Commercial Arithmetic for Secondary Schools,** by A. T. Batstone.

A treatment of annuities and of amortization may be found in Crawford's **Senior High School Algebra,** which, however, is now out of print. This book has some interest and present-worth tables and a table of mortality.

An excellent though advanced reference for teachers is Part III of **First Year College Mathematics,** by Hill and Linker (Henry Holt & Co.). Part III is entitled "Mathematics of Finance" and covers interest and discount, annuities, amortization, sinking fund, depreciation, bonds, life annuities and life insurance, and has a complete set of tables.

Re Tables

Interest and present-worth tables and a five-place table of logarithms are to be found in **A Canadian High School Arithmetic,** by Stanley and Smith (Oxford Press.) This book, however, is now out of print.

A very good set of tables for compound interest, present-worth and annuities may be found in Reference No. 6.

Division III. Technical Classes.

1. Volumes, as Reference No. 3, Chapter XII, page 205.
2. Laws of Sines and Cosines and their use in the solution of the oblique triangle.
   References.—No. 4, Chapters 4 and 9.
   No. 16, Chapters XII and XIII.
   No. 9, Chapter XIV.
3. Specific gravity and weight (including work with metric units.)
4. Use of tables of various types.
   (a) Specific gravity.
   (b) Weights.
   (c) Construction tables—as cement mixtures, shingles, etc.
   (d) Table connecting side and area of regular figures as in Reference No. 3, page 102.
5. Graphs—as above—using technical data—efficiency curves, etc. Excellent sets of tables concerning electrical data, construction data, materials, etc., may be had from electrical firms, such as Westinghouse, General Electric, Lumber Companies, etc.
   References.—No. 10, No. 3 and No. 14, Engineers' Handbooks.
6. Graphs of trigonometric functions with practical applications.
   References.—No. 18, No. 19 and No. 20.

General Mathematics 3

A course in General Mathematics 3 has been authorized as a third-year Technical Elective (Group C). An outline of this course is in preparation and will be available for use in September, 1940. During the year 1939-40, however, teachers may use the outline for General Mathematics 3 published in the mimeographed "Programme of Studies for Technical High Schools, Alberta, 1932 Revision," which is set forth here for convenient reference.

"The study of logarithms follows naturally from the work on indices in General Mathematics 2. It has also great value in connection with the computations involved in practical trigonometry.

"The subject of trigonometry utilizes much of the knowledge gained from the study of arithmetic, algebra and mensuration in the first two years of the Technical High School Course, and presents this knowledge from a new viewpoint. It has also many valuable applications in the more advanced work in electricity, physics and machine shop practice. For these reasons a study of the applications of elementary trigonometry forms the chief content of General Mathematics 3.

"Review of indices.

"Logarithms; use of logarithms to minimize calculation.

"Measurement of angles; positive and negative angles; sexagesimal measure.

"Trigonometric functions of acute angles; calculation of values of functions 0°, 30°, 45°, 60° and 90°. Use of tables of trigonometric functions; functions of angles up to 360°.

"Solution of right-angled triangles.

"Relation of the functions of an angle to those of its complement and supplement.

"Plotting curves of sine and cosine.

"Solution of oblique triangles.

"Sine law and cosine law.

"As far as possible the above elementary trigonometry should be applied in the solution of practical problems related to the shop unit which the student has elected, as well as to his work in mechanics. The following suggestions may assist the teacher in the selection of suitable problems:

"1. Calculation of peripheral speed of fly-wheels, grinders from angular velocity, and vice versa.

"2. Application of trigonometric functions to calculation of tapers, screw-threads, spirals; problems in inclined plane, angle of repose.

"3. Use of tables for evaluation of formulae involving trigonometric functions; illumination problems.

"4. Vector addition; application to composition and resolution of forces; triangle, parallelogram and polygon of forces; electrical calculations involving alternating current.

"5. Calculation of heights and distances that cannot be measured directly (in one plane only).

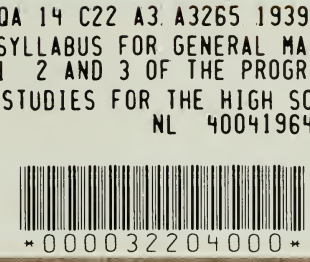
"6. Application of sine curve to alternating current electricity."

References.—No. 3, No. 4, No. 10, and also the following:

MECHANICS FOR THE UPPER SCHOOL: Merchant and Chant—Copp Clark Co.

ESSENTIALS OF ALTERNATING CURRENT ELECTRICITY: Timbie and Higbie—Wiley.

Special Note to the Teacher

It will readily be seen that the greater part of the foregoing outline for General Mathematics 3 has been included in the revised outline for General Mathematics 2 in so far as students specializing in technical subjects are concerned. However, a certain amount of overlapping and repetition is not necessarily a disadvantage, since the teacher of General Mathematics may not have had the time or opportunity during the year 1938-39 to deal with all of the material that has been outlined for the revised course in General Mathematics 2. The general principle to be followed is that students of General Mathematics 3 should take up the subject at the point where they left it at the end of the preceding year. Teachers who have capable advanced students may find it necessary to expand considerably the treatment of topics suggested above.

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